

REMARKS

Claims 1-4 and 26-29 are all the claims currently pending in the application. No claims are amended, as Applicant firmly believes that the pixel signature limitation that appears in all of the claims is not met by the prior art.

As subsequently demonstrated, the rejected claims expressly state that the pixel signature is based upon “the pixel alone” and/or “without reference to adjacent pixels.” These are clear limitations of the claims and are based upon an express disclosure in the present application. Nothing in the prior art teaches these limitations. Thus, Applicant respectfully submits that the claims should be patentable.

Claim Rejections - 35 U.S.C. § 103

Claims 1-4 and 26-29 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Alumot et al (5,699,447) in view of Tsai et al (4,845,558). For at least the following reasons, this rejection is traversed.

As a preliminary matter, Applicant respectfully requests the Examiner to give full and fresh consideration to the following bases for patentability of the claims based upon the express limitations in the independent claim 1 and 26, as replicated above for the Examiner’s convenience.

Key to the distinction over the prior art is the definition and understanding of the terms “signature of each pixel” and “pixel alone...without reference to adjacent pixels,” as defined in the specification, as limited by the remarks of the Applicant in the present application, and as would be understood by one skilled in the art. The invention, as defined by these terms, clearly is not taught in the cited art, as subsequently demonstrated.

The Invention

Since the present application is under final rejection, and a clear appreciation of the invention will avoid the need for an appeal, Applicant requests the Examiner’s indulgence in allowing a summary of the essential features of the invention based upon remarks previously submitted in the present application.

First, a core feature of the present invention is that it is directed to a pixel based inspection, rather than a pattern based inspection of semiconductor wafers (specification at page

7, lines 1-3). As explained at page 10, lines 2-13, the invention is based on identifying defective pixels (1) without reference to a pattern to which the pixel belongs, (2) to the position of the pixel on the wafer, or (3) without comparison between patterns. The first exception is particularly important as it clearly indicates that adjacent pixels or pattern features are not considered when evaluating a pixel.

Second, the basis for the comparison made according to the present invention is the scanning of an individual pixel of the semiconductor wafer defining a signature of each pixel. In the present invention, a determination is made as to whether the pixel signature for an individual pixel has characteristics of a faultless or a defective pixel (page 11, lines 2-7). All of the claims refer to the detection of the signature of each pixel. This term is expressly defined as the area [of the wafer] covered by the spot of the beam at the moment the sampling is carried out (page 16, lines 19-22). By virtue of this definition, the spot beam does not illuminate other pixels and their features cannot be considered.

Third, the term is expressly stated in the claims to mean “the way in which the pixel alone responds to the light of a scanning beam without reference to adjacent pixels.” (emphasis added) This limitation means that none of the intensity, shape, pixel type , proximity or other characteristics of adjacent pixels are considered in extracting a pixel signature.

Alumot

As previously discussed, the patent to Alumot teaches the inspection of a wafer using strings of pixels of images related to an inspected pattern and a reference pattern. The Examiner admits that Alumot fails to disclose the detection of a pixel alone and without reference to adjacent pixels, for the signature of the pixel. The teachings in Alumot reflect the technology in the time frame of the early 1990's. Advanced defect detection technology of that time, which focused on in semiconductor manufacturing processes, considered comparisons that were designated to be “pixel-by-pixel” to be based at least on both intensity and “pixel type.” As taught at col. 10, lines 47-54, the pixel type is based on signal intensity and shape in a 3x3 neighborhood. The characteristics were always determined with reference to adjacent pixels.

As explained at col. 19. line 52-col20, line 28, the function of the image comparator 77 is to carry out a comparison between the inspected image in the vicinity of a current pixel and the

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referenced image in the vicinity of the corresponding pixel. Alumot teaches that this involves something more than a signature of the a single pixel. Specifically, this comparison is based on a 3x3 neighborhood matrix centered on a pixel of interest, Thus, a single pixel is compared to the 9 pixels in the 3 x 3 neighborhood centered at the corresponding reference pixel. Each of 9 comparisons is made by the comparing the difference between energy of the compared pixels against a threshold determined by the pixel type. The energy of a pixel is the sum of the 9 pixels in the 3 x 3 neighborhood at the pixel. The phase 2 examination, which is disclosed beginning at col. 21, line 73 is similar in its “pixel-by-pixel” comparison, in that the neighborhood and vicinity of a subject pixel must be considered in determining the characteristics of any given pixel.

Tsai et al

The Examiner looks to Tsai et al for a further teaching of a “pixel-by-pixel” comparison for detecting defects on a wafer. However, this reference, which reflects technology from the late 1980’s, even earlier than that of Alumot, teaches nothing more than the comparison of a given pixel characteristic that is necessarily based on other pixels in the neighborhood or vicinity. The technology of the time would not allow an examination of a single pixel alone without considering other pixels in the neighborhood or vicinity in determining the characteristics of a given pixel.

The Express Limitations of the Claims Are Not Found in the Prior Art

Claims 1-4 expressly state that the pixel signature is based upon “the pixel alone” and all or the rejected claims state that a comparison is made “without reference to adjacent pixels.” These are clear limitations of the claim and are based upon an express disclosure in the present application. These limitations must be found in the prior art for a proper rejection. Nothing in the prior art teaches these limitations.

First, as to Alumot, as already discussed, there is no relevant teaching. The “pixel-by-pixel” comparisons are expressly based on neighboring pixels in a matrix, or those in the vicinity.

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Second, as to Tsai et al, there is no express teaching in Tsai et al of what is meant by a “pixel-by-pixel” comparison. As already demonstrated, at the time of the filing of Tsai et al, the term meant a comparison of features in the neighborhood or vicinity of a given pixel.

The Examiner refers to the text at col. 3, lines 42-52 for support, as it refers to an inspection of features of the pattern where “the pixel or pixels containing the subject pattern are compared to any other pixel or group of pixels containing the same feature, and if there is a material variance between the two, then a defect has been detected.”

The above quoted text is insufficient to teach an evaluation of a pixel without reference to other pixels. The only teaching is of a “pixel-by-pixel” comparison. There is no statement of the basis for that comparison. The only available interpretation in the cited art is that offered by Alumot, and that interpretation is clearly a meaning based on a consideration of other pixels in the neighborhood or vicinity. Thus, even if one pixel’s features may be compared to another pixel’s features, those features are determined on the basis of adjacent pixels. Nothing in Tsai et al suggests that the effect of other pixels should be avoided, and indeed, the clear impression of the teaching in both references is that the field of view for the camera is a matrix or group of pixels.

Applicants respectfully submit that the Examiner is improperly using the Applicants’ own teachings to recreate a definition of “pixel signature” without support in any prior art reference. Moreover, Applicants’ definition is expressly provided in the claim and not just by interpretation of the specification. Thus, the Examiner cannot simply extrapolate from the limited teachings of Alumot and Tsai to find a proper basis for unpatentability, but must find an express teaching in the prior art of a “pixel signature” that is based upon “the pixel alone” and “without reference to adjacent pixels.” This has not been done.

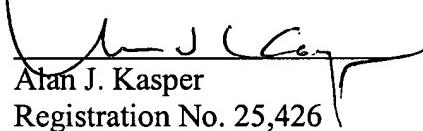
In the absence of any teaching in either reference of the claim limitation that requires the use of the signature of each pixel, defined by the way in which the pixel alone responds to the light of a scanning beam without reference to adjacent pixels, the claims cannot be considered unpatentable.

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In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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